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ABSTRACT

An on-going study is examining a method proposed by S. Goetz and D. Debertin for estimating demand for educational attainment at the county level by using secondary data. The method produces compact information showing the relationship between employment, occupation, and educational attainment, information not available at the county level. The method offers a way to obtain such information without conducting a costly and time-consuming survey. The information obtained allows local government to estimate the quality-type of workers (as reflected by their educational attainment) required by particular types of occupations demanded by private businesses in the county, and to assess the training needs of its workforce. A case study of Taylor County, West Virginia, was conducted using 1990 census data and data from the Current Population Survey and Occupational Employment Statistics Survey for 1997. Four different methods were shown to be feasible for generating the pattern of occupational distribution of employer demand for workers with various education levels. Two main assumptions of the Goetz-Debertin method were evaluated: a fixed proportion of types of education required per individual occupation, regardless of sector, and a fixed proportion of types of occupation required per individual sector. (Contains 17 data tables and figures.) (SV)

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Estimating Employer Demand for County Level Educational Attainment: A Case Study of Taylor County, West Virginia

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Abstract: This is an on going study, examining a method proposed by Goetz and Debertin on how to estimate demand for educational attainment as county level utilizing secondary data. This study found that the method is potentially a powerful one. The method produces compact information on the types of the employees' educational attainment demanded by employers, and how they relate to the types of occupations and sectors. This output allows people to see, for instance, how skills requirement (indicated by educational attainment) for the same occupation differs when the demand comes from different sectors. The method also gives a better way to assess the kinds of training needed for the workforce. This method, however, works under two main assumptions: (1) a fixed proportion of types of education required per individual occupation, regardless of the sectors, and (2) a fixed proportion of types of occupation required per individual sector. Whether these assumptions are reliable remains to be seen. The study will conduct a primary data survey to examine that.

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ESTIMATING EMPLOYER DEMAND FOR COUNTY LEVEL EDUCATIONAL ATTAINMENT

Case Study: Taylor County, West Virginia

Introduction

The process of devolution, a process of where governmental power shifts to local agents, is not limited to the United States. Instead it is an on going phenomenon happening across the world (Loveridge, 1999). In line with that the role of local government in policy making has been gradually increasing. This trend leads local government to have a greater responsibility. To keep up with its responsibility to make its policies effective, local government consequently requires more information on its local socio-economic variables.

There has been a substantial progress of the Federal government service to provide the public with more local information. The 1990 Census publications, for instance, now have made available information on socio-economic characteristics that goes even to the county level. However, as it takes time to keep up with growing demand, people sometimes might have to utilize second-best information available (which is not necessarily information on local economies), process and manipulate it in such a way that it becomes meaningful to local government.

One of the very important kinds of data required by any government is information on employment. Obviously the more the local government learns about how the local employment characteristics relate to other socio-economic variables, the more likely it can come up with more effective policies. This study is one of the ideas on how to utilize some general information to produce useful information on local employment. This study builds on a method proposed by Goetz and Debertin[1]. They estimated demand for educational attainment at the county level by utilizing only secondary data. Results obtained from this method are in the form of compact information showing the relationship between employment, occupation, and educational attainment, information that is not available at county level.[2] The method offers a way to enable people to obtain such important information without having to conduct a survey, which is believed to be costly and more time consuming. The information obtained with this method allows local government to estimate the quality type of workers (which is reflected by their educational attainment) required by particular types of occupations as demanded by private industries in the county. The method also provides insights about the local labor market situation, allowing policy makers to assess what general types of training might be relevant for the workforce.

There are two main parts or objectives of this study. First, this study examines how the method estimates and then makes use of its results to generate information that is

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[1] Goetz, Stephan J. and David L. Debertin. 1993. "Estimating County-Level Demand for Educational Attainment." *Socio-Economic Planning Science*. Vol. 27. No.1, pp. 25-34.

[2] Actually the 1990 Census publications have made available local information on employment by occupation, by sectors, and by educational attainment. The information of each variable, however, is reported separately instead of compactly combined as this method offers.

meaningful to the local government. To do this the study arbitrarily chose a county (Taylor County, West Virginia) as a case study. Secondly, the study evaluates whether such method is accurate, based on primary survey data. A phone survey will be conducted to collect the same information, and then compare the survey results to that obtained from the non-survey method. In the end, based on the results of the comparison, the study will propose ways of refining the method. The current paper, however, discusses only the first part of the study. Discussion on the second part of the study will be presented in another paper after the survey is completed.

Training Needs Assessment

There are basically two forms of training: 'qualifying training', which is required for people to get a job, and 'training to improve skills', which is taken after people get a job. Empirical data indicates that the proportion of people taking both forms of training has been increasing over time. Alan Eck (1993) also found that workers having training gained higher earnings than those who didn't have one. This reflects that training indeed increases workers productivity.

How training plays role in increasing productivity depends on how the types of training matches what the firm needs. To a large extent the kinds of training needed depends on the types of occupations that the firm has. So in most cases identifying training needs is a firm specific issue. Logically firms tend to look for 'more general' kinds of skills when they ask for qualifying training, whereas for 'training to improve skills' firms will conduct their own company training pertained to more specific skills. For example, having training in general managerial skill is probably required for applicants to take managerial position. After being hired, those managers might need to take training on more specific managerial skills such as problem solving, employee motivation, effective communications, or effective planning, etc. A great deal of management literature is available, offering various techniques on how to identify the right training for firms.

Local government has also responsibility to provide training for the public. This is part of its role as public service. The way the government assesses the kinds of training necessary for the public is somewhat different from firms. The main objective is to help the workforce to do better in their work, and the target is usually people who are disadvantaged in the labor market. It is true that in the end this objective ideally should match firms' objective, as a better-prepared workforce is more productive. Technically speaking government has to rely on more general public information. Consequently the kinds of training provided by the government will be training on basic skills that can apply to a broad range of tasks. The government has to find the best way to make the most effective use of training dollars.

State bureau of employment program, in cooperation with Bureau of Labor Statistics, have been conducting Occupation Employment Statistics (OES) survey. They survey businesses to collect information on types of employee occupations as well as their earnings, in each individual state. This survey gives an alternative source of data on local employment, which is commonly provided by decennial census or current population survey. The advantage of this data source is that, besides being annually updated, it estimates occupations in the demand side instead of supply side. This possibly would

improve the accuracy of estimating labor-skills demanded by private businesses in a county. This data source, however, due to its small sample size, has not yet made available information for county level.

The Federal government has also released the Workforce Investment Act of 1998, which is intended to help regions improve connections between training providers and employers. One aspect of this Act is to involve private businesses in identifying the kinds of training to be provided for public, and to allow local government to come closer to private sector needs. This should also improve the accuracy in estimating the skills demanded in the labor market.

Goetz and Debertin method also tries to give a better estimate of demand for labor skills. As briefly mentioned before this method gives more compact information on employees type of occupation, educational attainment and type of sector. Technically speaking it will specifically define what educational attainment is required for employees to be, say, managers or sales if they are working in sector A. The method will allow people to see how the skill requirement differs when the job is in sector B. It will also allow people to see how educational attainment matters for people to obtain higher rank of occupations if they are working in different sectors. This fact might be in line with Nelson and Phelps idea (in Johnson, 1971) that firm's demand for educational attainment is based on its marginal contribution to cope with technological change. They argued that "[in] the absence of technological change, marginal product of educational attainment is zero." Obviously different sectors might imply different potential for technological change.

Knowing the relationship between employee type of occupation (which reflects type of skills) and educational attainment should also give better assessment of training needs. Obviously more educated people can take more complicated training material. Alan Eck (1993) and George E. Johnson (1971) found that people with higher educational attainment had more company training to improve skills. Eck further argued that more educated people have higher interest in training, which might be due to the fact that they gained more substantial benefit from training. Interestingly Florence D. Tucker (1985) found that such a relationship between educational attainment and interest in company training was found significant only for older workers. This might reflect the fact that older workers need more job stability than younger workers who still have more chance to take different jobs that require different skills.

Modifying the Method

The Goetz-Debertin method was originally applied to 1980 Census data. This method requires three - and only three - types of data, two of them are state-level data and the other one is county-level data. Those three types of data are: (1) a state level data of a cross-tabulation between occupation and educational attainment; (2) another state level data of a cross-tab between occupation and sector; and (3) county level data of employment by sectors. From the first two data the method generates a state-level "requirements matrix", which becomes a three-way cross tabulation among occupation, educational attainment and sector.[3] A requirements matrix describes the proportion of

[3] For more information on how the method works, see appendix.

workers with particular educational attainment hired for each type of occupations within a sector. The proportion is assumed to be constant everywhere across counties within the state. In the end multiplying the matrix with the county-level data of employment by sectors, one could estimate the local demand for educational attainment.

However, when it came to apply the Goetz-Debertin method a problem arose. The secondary data proposed by the method is no longer published in the same way it was from the 1980 Census. In short, except for the county level data, what was regarded by Goetz and Debertin as "readily available secondary data" now is no longer easily obtained. This called for a different way of collecting the required secondary data.

The two state-level data, data (1) and data (2), are both set up in the form of cross-tabulations. It occurred that the crosses were between variables that each of them has several (more than three) categories. Almost all of the 1990-Census and other data sources publications, however, present information on single variables, let alone cross-tabulated variables. If there are few cross-tabulations, they are among variables with only 2-3 categories such as race, sex, etc. As will be seen, the variables used in this method have at least five categories. So to get the state-level cross-tabulation data, one needs to develop data (1) and data (2) by themselves.

Fortunately, as the government develops its service to provide publicly available data on employment, people now have access to micro data (in CD-Rom) containing data obtained from census or surveys conducted by government. There are now several other d. urces other than the 1990 Census that are applicable for this method. This particular study uses three data sources to create the state-level requirements matrix: the 1990 Census of Population and Housing PUMS (5% sample) and two other data sources that contain more recent data on employment: Current Population Survey (CPS) 1997, and Occupational Employment Statistics (OES) Survey 1997.[4]

So given the availability of the different data sources, this study generates four different ways to create four different requirement matrices, implying that in the end there will be four different estimations obtained. The study will do the estimation using every one of them and then compare the results with survey results to conclude which data source provides the most accurate information. The four different methods are:

a. Method (a): using the 1990 Census data to create data (1) and data (2) and then multiply them both to generate one requirements matrix. This is the standard method as suggested by Goetz and Debertin. Denote this method as "Census 90_2".

b. Method (b): using the 1990 Census data to directly create one requirements matrix. This is a one-step creation instead of 2-steps as in method a. This method directly creates a three-way cross-tabulation matrix. This method relaxes the assumption used in method a, that each occupation across industries exhibits a

[4] Note here that data from OES survey 1997 is publicly available by request to the State Employment Security Agencies.

constant proportion of educational attainment. Denote this method as "Census 90_3".

c. Method (c): the same method as in method a, but using CPS 1997 data. Applying method b to this data set is not recommended because CPS 1997 was based on a much smaller sample size such that manipulating it for further detailed will create large standard errors. Denote this method as "CPS_97".

d. Method (d): the same method as in a and c but using OES 1997 survey to create data (2) and using Census 1990 data to create data (1).

Taylor County Estimates

As mentioned above, this study picks Taylor County as a case study to see how the method works. To go through the analysis, two terms are introduced: "state specific" and "county specific". The term "state-specific" refers to a feature that is applicable at a state level. In this study a state-specific feature applies also to each individual county within the state (by assumption). For example, the requirements matrix, in relative terms, is state-specific. This method assumes that each county within West Virginia exhibits the very same requirements matrix. In other words there is no difference between one county and another with regard to a state specific feature. On the other hand a county-specific feature refers to the one that is applicable only to a particular county but not to another county. Data (3), the county-level employment data by sectors is county-specific. It features only employment by sectors in one county. These two terms are necessary to distinguish whether an analysis is describing West Virginia or only describing Taylor County. All cross-tabulation results that involve a summation across sectors would be county-specific because distribution of sectors is county-specific, other than that they are state-specific. In this paper, the features presented in Table 1, Table 3 through Table 5, and Table 11 are county specific, whereas those presented in Table 6 through 10 are state-specific. Table 6 through 10 presents the distribution of demands per individual sector.

It is important to note that in terms of policy implication absolute figures might matter more than relative figures because they give the idea of the real magnitude of the matter. Obviously, in absolute terms all cross-tabulation results are county-specific.

The following section will present what kind of results one can obtain by applying method (a) (the standard method using data from the 1990 Census) to estimate employment in Taylor County.

General Characteristics of Employment in Taylor County, West Virginia.

Services, manufacturing, retail trade, and construction were the dominant industries in Taylor County, taking up almost 85% of employment. In the other five sectors, each contributes to only less than 5% of employment in the county (See Table 1). Service and Retail-Trade industries can usually be categorized into non-exporting industries (Other industries in the same category normally would be: transportation, wholesale-trade, and finance.) All these five non-exporting industries contributed almost 65% of all employment in Taylor County. This suggests that about this proportion (65%) the

economic activity in the county was to a large extent determined by interactions among its own local economic agents.

Table 1. Employment by Sectors, Taylor County 1997

Sectors	Employment	
	1997	Percent
Agriculture	19	0.6
Mining	51	1.6
Construction	324	10.1
Manufacturing	772	24.0
Transportation	194	6.0
Wholesale Trade	124	3.8
Retail Trade	752	23.3
Finance	118	3.7
Services	869	27.0
TOTAL	3223	100.0

Source: Regional Economic Information System, Bureau of Economic Analysis

Agriculture, mining, construction, and manufacturing belong to the exporting industries, representing those that are more affected by outside economic fluctuations. Of all employment in those four industries (which contributes to 36.3% of all employment in the county), 66% of them were in manufacturing, and 28% of them were in construction industries.

To sum up, the non-exporting industries were to a large extent determined by the performance of services and retail-trade industries, while exporting industries are dominated by manufacturing and construction industries.

The Requirements matrix

The results of the estimation will completely depend upon two matrices, the requirements matrix, which is state-specific, and the county-level employment data, which is county-specific. The differences between counties are determined by differences in the structure of local industries. Some county can be dominated by exporting industries, some other by non-exporting industries.

Table 2 shows how the state-specific requirements matrix looks. Only figures in the four dominant industries (instead of all 9 industries) are presented in Table 2. The

Table 2. The Requirements matrix, West Virginia, 1997.

SECTOR	Educational Attainment					
	0-8 years	some HS	HS-grad	some college	≥ 4 years of college	Total
SERVICES						
Managers	0.1	0.5	2.3	2.0	3.0	7.9
Professionals	0.2	0.8	4.4	5.4	22.8	33.5
Sales Occupations	0.1	0.3	0.9	0.5	0.3	2.1
Clerical Workers	0.3	1.1	7.2	5.0	2.1	15.6
Service Workers	2.7	7.7	12.4	5.0	1.8	29.6
Farmers & Workers	0.1	0.2	0.3	0.1	0.1	0.8
Production & Craft	0.5	1.0	2.3	0.7	0.3	4.9
Operators	0.5	0.9	2.2	0.5	0.1	4.2
Laborers	0.1	0.4	0.6	0.2	0.0	1.3
Total	4.6	12.9	32.6	19.4	30.5	100.0
MANUFACTURING						
Managers	0.1	0.4	1.9	1.7	2.6	6.7
Professionals	0.0	0.2	1.0	1.2	5.1	7.6
Sales Occupations	0.1	0.5	1.3	0.8	0.5	3.1
Clerical Workers	0.2	0.7	4.5	3.1	1.3	9.7
Service Workers	0.2	0.6	0.9	0.4	0.1	2.3
Farmers & Workers	0.3	0.4	0.5	0.2	0.1	1.5
Production & Craft	2.0	4.0	9.3	2.9	1.3	19.5
Operators	4.5	8.7	20.9	4.9	1.4	40.4
Laborers	0.9	2.4	4.2	1.2	0.3	9.1
Total	8.3	17.9	44.7	16.4	12.7	100.0
RETAIL TRADE						
Managers	0.1	0.4	1.7	1.5	2.3	6.1
Professionals	0.0	0.1	0.3	0.4	1.6	2.3
Sales Occupations	1.2	6.2	17.5	10.4	6.1	41.4
Clerical Workers	0.1	0.5	3.5	2.4	1.0	7.5
Service Workers	2.3	6.5	10.4	4.2	1.5	24.9
Farmers & Workers	0.0	0.1	0.1	0.0	0.0	0.2
Production & Craft	0.6	1.2	2.7	0.9	0.4	5.7
Operators	0.4	0.8	1.9	0.4	0.1	3.7
Laborers	0.9	2.2	3.8	1.1	0.3	8.3
Total	5.5	17.9	42.0	21.3	13.2	100.0
CONSTRUCTION						
Managers	0.1	0.5	2.0	1.8	2.7	7.0
Professionals	0.0	0.1	0.4	0.5	2.0	2.9
Sales Occupations	0.0	0.1	0.4	0.2	0.1	1.0
Clerical Workers	0.1	0.3	2.3	1.6	0.7	4.9
Service Workers	0.1	0.3	0.4	0.2	0.1	1.0
Farmers & Workers	0.1	0.2	0.2	0.1	0.0	0.5
Production & Craft	5.0	10.1	23.4	7.4	3.2	49.1
Operators	1.6	3.2	7.6	1.8	0.5	14.7
Laborers	1.9	5.0	8.8	2.5	0.6	18.9
Total	9.0	19.7	45.4	16.0	9.9	100.0

HS= High-School. HS-grad=High-School graduate. Some College = Some Years in College, No Bachelor Degree

Table 3. Demand for Educational Attainment in Taylor County, West Virginia.

SECTOR	Educational Attainment					
	0-8 years	some HS	HS-grad	some college	≥ 4 years of college	Total
SERVICES						
Managers	1	5	20	17	26	69
Professionals	1	7	34	47	198	291
Sales Occupations	1	3	1	5	3	18
Clerical Workers	2	9	63	43	18	136
Service Workers	24	67	108	44	15	258
Farmers & Workers	1	2	3	1	1	7
Production & Craft	4	9	20	5	3	42
Operators	4	5	19	4	1	37
Laborers	1	3	5	2	0	12
Total	43	112	253	164	265	869
MANUFACTURING						
Managers	1	3	15	13	20	52
Professionals	0	1	5	4	48	58
Sales Occupations	1	4	10	6	4	24
Clerical Workers	1	5	35	24	10	75
Service Workers	2	5	7	3	1	17
Farmers & Workers	2	3	4	1	1	12
Production & Craft	15	31	72	23	10	151
Operators	35	67	161	38	11	312
Laborers	7	19	33	10	2	71
Total	64	138	345	127	98	772
RETAIL TRADE						
Managers	1	3	13	11	16	44
Professionals	0	0	2	3	12	17
Sales Occupations	9	47	132	76	46	311
Clerical Workers	1	4	29	18	7	47
Service Workers	17	49	76	32	11	187
Farmers & Workers	0	0	1	0	0	2
Production & Craft	4	9	20	6	3	43
Operators	3	6	14	3	1	28
Laborers	6	17	29	8	2	62
Total	42	135	316	161	100	752
CONSTRUCTION						
Managers	0	1	6	6	9	23
Professionals	0	0	1	2	6	9
Sales Occupations	0	0	1	1	0	3
Clerical Workers	0	1	7	5	2	16
Service Workers	0	1	1	1	0	3
Farmers & Workers	0	0	1	0	0	2
Production & Craft	16	33	76	24	10	159
Operators	5	10	25	6	2	48
Laborers	6	16	28	8	2	61
Total	29	64	147	52	32	324

HS= High-School. HS-grad=High-School graduate. Some College = Some years in College. No Bachelor Degree

distributions are allocated by industries, imposing the condition that the proportions in one sector always sum up to 100 percent. From Table 2 it is shown that of all 100 percent employees working in services sector in West Virginia (not in Taylor County), 22.8 percent of them are required to have 4 or more years of college education to take the job as professionals. Similarly of all 100 percent workers in manufacturing sector in West Virginia, 20.9 percent of them are required to have high-school diploma and to work as operators. Again recall that this feature is state-specific, meaning that each county in the state will have the same proportions of requirements. Obviously when a county is dominated by mining industries, it becomes relatively less important to pay attention to the proportions within, say, agricultural sector.

Demand for Educational Attainment in Taylor County, West Virginia

Now, combining Table 1 and Table 2 yields a county-specific matrix of demand for educational attainment in Taylor County because the figures are in absolute terms. The result is presented in Table 3. Again only the results in the four dominant industries are presented.

Information in Table 3 is the kind of information needed by the local government to develop its local employment policies. Local government now can see that approximately as many as 161 people are required to work as operators in manufacturing sector and to have high school diploma. Table 3 also shows that the most highly educated work force is mostly demanded by the services sector. As many as 198 people with 4-or more years of college education are required by services sector to work in professional occupations.

Basically based on this kind of information local government has the knowledge to make predictions about the magnitude and the quality of workforce demanded by local private businesses, say, next year when local government is able to forecast that a particular sector will grow by a certain percent next year. Obviously forecasts of employment by sectors is the most-commonly made forecasts. Having this matrix local government now can get much more information by interpreting a simple employment forecast.

Labor Market Situation in Taylor County

The following section presents how to make use of the information in Table 3 to derive more information so that one can learn more about local labor market situation. It is important, however, to note that analysis on Table 4 and Table 5 has to be taken with great caution. Although the absolute figures in both tables represent the absolute numbers of employment in Taylor County, the distribution, however, follows that imposed by the requirements matrix, which is state-specific. So with regard to Table 4 and Table 5, discussions about percentage distribution actually describe more about distributions in the state than in the County.

Another interesting feature about local employment is to see how many of the jobs in those industries above were in the top-level how many were in the middle and in the low-level of occupations. Table 4 shows how demand for employees in Taylor County might be distributed across types of occupations.

The order of the occupations in Table 4 very roughly reflects the order of the position-levels in terms of pay. Managerial and professional occupations in general represent the top-level positions, whereas from sales occupations down to operators occupations can be perceived as the broad range of the middle-level positions. Helpers/laborers roughly represent the low-level position.

At first glance the jobs seemed to be evenly distributed across all position levels. A further look, however, shows that about 20% of them were in the top-level positions (managers and professionals), about 73% of them were in the middle-level positions, and the rest 7.3% were in the low-level positions (helpers). Also notice that farmers and workers occupations contributed to only 1.2% of all employment demand.

Table 4. Employment Demand by Occupation, Taylor County 1997

Occupation	Taylor County Employment		US Employment, 1990
	1997	*Percent*	*Percent*
Managerial	244	7.6	12.3
Professional	397	12.3	17.8
Sales Occupations	430	13.3	11.8
Clerical Workers	408	12.7	16.3
Service Workers	480	14.9	13.2
Farm-Service Workers	40	1.2	2.5
Prod. Precision Workers	471	14.6	11.3
Operators	518	16.1	10.9
Helpers/Laborers	236	7.3	3.9
T O T A L	3223	100.0	100.0

Source: Imputed from Regional Economic Information System - Bureau of Economic Analysis, and 1990 Census of Population and Housing PUMS (5% sample) - Bureau of Census.

Compared to the national distribution Taylor County experiences lower demand for the top-level occupations (19.9% compared to 30.1%) and a larger portion of the low-level occupations (7.3% compared to 3.9%) suggesting that in general the labor market situation in Taylor County is still a little below the national average.

If type of occupations roughly reflects skills required for the jobs, then occupational distributions might reflect the distributions of the employees by their skills. This is examined in Table 5.

Obviously skill is determined not only by formal education but also by on-the-job training and experience. However, formal education is usually considered to be a strong indicator of skill. Table 5 shows how employees were categorized into their educational attainment.[5]

[5] Table 5 was obtained from multiplying the requirements matrix with county employment data, and then adds up each cell of number of employees in it according to the occupation they belong to. The requirements matrix is a matrix whose each of its cells tells the proportion of people with particular educational attainment being hired for each type of occupation within individual industries. This requirements matrix is assumed to be the same for individual counties in West Virginia.

The distribution is quite close to what was implied by the occupational distribution above. About 18% of the employees demanded were holding 4-years-or-more of college education, about 60% holding HS-graduate or less-than-4-years of college education, about 16% holding some-years of HS-education, and the last one 6.3% of them holding less-than-HS education.

Table 5. Employment Demand by Educational Attainment, Taylor County 1997

Educational Attainment	Taylor County Employment	
	1997	*Percent*
0-8 years (less than HS*)	204	6.3
some HS	523	16.2
HS graduates	1312	40.7
0-3 years of college	615	19.1
4 years of college or more	569	17.6
TOTAL	3223	100.0

* HS: High School.

Source: Imputed from Regional Economic Information System - Bureau of Economic Analysis, and 1990 Census of Population and Housing PUMS (5% sample) - Bureau of Census.

The mode level of education was "HS-graduate", about 40% of all employment demand was for this level of education. This was in fact the level of education with which most of the labor supply comes to the job market. It would be of no surprise if most of the jobs were concentrated in the middle level positions, which eventually were taken by these HS-graduates. Surprisingly, however, the employment of workers whose education was less-than HS-graduates was high: 22.5% combined. This suggests that the local firms in this county might not have too many choices except to hire them to fill out not only low-level positions but also middle-level positions.

Demand for Educational Attainment Within Individual Industries

A further examination is to see how each individual sector filled their positions given the available supply of the educational attainments. The study presents only the examinations on the four dominant sectors: services, manufacturing, retail-trade, and construction, which should be representative enough to describe the overall employment.[11]

Services Sector – Recall that services sector had the largest share of employment in the county (27%). Besides hiring the largest number of employees, services sector was also the sector that hired most of the highly skilled workers in the county. Table 6 shows that almost half of all employees in this sector were those who had "4-years-or more college" or "some-college" education. This implies that no matter where the supply of highly skilled workers comes from, it is this services sector that attracts them to come the local job-market. It is important to have more and more highly skilled employees because it can increase the average labor productivity of the county. Now, to see it from the other point of view, the attractiveness of the local job-market would depend on the

[11] The discussion in this section will be based on Table 6 through Table 9. These tables were created in the same way as Table 5 above, only that the summation by occupation was computed in each specific sector instead of all across sectors combined, and by each level of educational attainment instead across all levels combined.

performance of this sector. Recall that services sector reflects the dynamics of the local socio-economic interactions, and business in this sector includes business & repair services, personal services (hotels, beauty shops, lawyers etc,), entertainment & recreation services etc. So any local government policies that strengthen this local dynamics might as well strengthen the performance of its services sector.

Table 6. Percentage Distribution of Employment Demand in the Services Sector by Occupation and Educational Attainment, Taylor County 1997.

Occupations	Percent of Employment with educational attainment of:					
	Less than HS	some HS	HS-grad	Some college	≥ 4 years of college	Total
Managerial	2.8	4.0	6.9	10.2	10.0	7.9
Professionals	3.5	5.9	13.6	27.6	74.6	33.5
Sales Occupations	1.3	2.4	2.7	2.7	1.0	2.1
Clerical Workers	5.7	8.4	22.2	25.6	6.8	15.6
Service Workers	59.5	59.9	38.0	26.0	5.7	29.6
Farmers & Workers	3.2	1.8	0.9	0.5	0.2	.0.8
Prod. Precision & Repairers	10.9	7.7	7.1	3.8	1.0	4.9
Operators	10.2	7.0	6.7	2.6	0.5	4.2
Helpers/Laborers	3.0	2.7	1.9	0.9	0.1	1.3
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0
% of All Education	4.6	12.9	32.6	19.4	30.5	100.0

Source: Imputed from Regional Economic Information System - Bureau of Economic Analysis, and 1990 Census of Population and Housing PUMS (5% sample) - Bureau of Census.

What kinds of occupations were required by the services sector? The jobs in this sector were mostly for professional occupations (33.5%), service-workers occupations (29.6%), clerical-workers occupations (15.6%), and managerial (7.9%). Note that of all the most-educated workers working in this sector, 84.6% of them are in the top-level occupations, managerial & professional occupations. Demand for workers with "some-college" education, was more diverse. However, as people would expect, compared to that of the most-educated workers, fewer workers were in the top-level occupations (27.8% combined) and more were in the middle level position, although (26.0% in service-worker & 25.6% in clerical occupations). As for workers with less educational attainment, there was less demand for workers in the top-level occupations, and more in the middle and low-level occupations. Interestingly, the least educated workers, those with "less than HS" education, had the kinds of jobs similar to that taken by the workers with "some years in HS", that is about 60% of each of the two groups of workers taking the service-worker occupations. Also notice that only small portion of the ended up as helpers (around 3%). This suggests that there was a broad range of skills required for occupations in the services sector, and that the services sector was not a bad market even for the least-educated workers.

Manufacturing Sector – Only a small portion of demand for employees in the manufacturing sector is in the top-level positions. Table 7 shows that only 14.3% of all employment demand was for managerial and professional occupations, while 69% was in the fairly low level positions such as production precision & repairers, operators, and helpers occupations. Not surprisingly a greater demand for the less skilled labors came from this sector. As many as 25.3% of the workers demanded in this sector had less than

HS-graduate education. Surprisingly, 61.8% of manufacturing workers had "HS-graduate" or "some-college" education, yet most of them worked for the same types of occupations as the workers with less than HS education did (production precision & repairers, operators, and helpers). In other words the demand for all workers, except that of the most-educated workers, were concentrated in these three occupations. This suggests that for the three types of occupations in this sector the educational differences did not seem to significantly affect the position levels of the jobs. Putting it another way, this suggests that this sector might be the first place for the unskilled labors to find jobs, but in the same time also perhaps the last resort for those more skilled labors holding "HS-graduates" and "some-college" education.

Table 7. Percentage Distribution of Employment demand in the Manufacturing Sector by Occupation and Educational Attainment, Taylor County 1997.

Occupations	Percent of Employment whose educational attainment is					
	Less than HS	some HS	HS-grad	Some college	≥ 4 years of college	Total
Managerial	1.4	2.5	4.2	10.1	20.0	6.7
Professionals	0.5	1.0	2.2	7.3	40.1	7.6
Sales Occupations	1.1	2.7	2.9	4.7	3.6	3.1
Clerical Workers	2.1	3.9	10.0	18.6	10.0	9.7
Service Workers	2.6	3.4	2.1	2.3	1.0	2.3
Farmers & Workers	3.4	2.5	1.2	1.1	0.8	1.5
Prod. Precision & Repairers	25.3	23.1	20.6	17.7	10.0	19.5
Operators	54.0	48.4	46.8	29.9	11.2	40.4
Helpers/Laborers	11.4	13.5	19.5	7.5	2.3	9.1
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0
% of All Education	7.9	17.4	45.2	16.6	12.8	100.0

Source: Imputed from Regional Economic Information System - Bureau of Economic Analysis, and 1990 Census of Population and Housing PUMS (5% sample) - Bureau of Census

Table 8. Percentage Distribution of Employment Demand in the Retail-Trade Sector by Occupation and Educational Attainment, Taylor County 1997.

Occupations	Percent of Employment whose educational attainment is					
	Less than HS	Some HS	HS-grad	Some college	≥ 4 years of college	Total
Managerial	1.7	2.2	4.1	7.2	17.7	6.1
Professionals	0.2	0.3	0.7	1.7	11.8	2.3
Sales Occupations	20.4	34.9	41.6	48.8	46.1	41.4
Clerical Workers	2.2	2.9	8.3	11.2	7.5	7.5
Service Workers	40.4	36.4	24.7	19.9	11.1	24.9
Farmers & Workers	0.7	0.3	0.2	0.1	0.1	0.2
Prod. Precision & Repairers	10.3	6.5	6.4	4.0	2.8	5.7
Operators	7.4	4.4	4.6	2.1	1.0	3.7
Helpers/Laborers	15.4	12.2	9.2	5.2	2.0	8.3
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0
% of All Education	5.6	17.8	42.0	21.3	13.2	100.0

Source: Imputed from Regional Economic Information System - Bureau of Economic Analysis, and 1990 Census of Population and Housing PUMS (5% sample) - Bureau of Census

Retail-Trade Sector – Retail-trade sector is also one of those industries that strongly reflect the dynamics of the local economy. Sales and service workers occupations were

the largest part of the labor demand in this sector, taking up about 66.3% of all employment in the sector (see Table 8). Not surprisingly the moderately educated workers with "HS-graduate" and "some-college" education were demanded by sales and service employers. It turned out also that a lot of those with "some-HS" education were demanded by this sector and at the same time held the same kinds of occupations (sales and service workers). Again this suggests that there was no significant difference, in terms of their propensity, between HS-graduates and those with only some-HS education to be demanded for sales and service occupations in this sector.

Construction Sector – Employment demand in the construction sector looks similar to that in the manufacturing sector. However, instead of being concentrated in three kinds of occupations (production precision & repairers, operators, and helpers), demand for occupations in this sector is concentrated in: production precision & repairers, and helpers only (See Table 9). In fact, in terms of proportions, there was a larger demand for workers with less than HS-graduate education (28.9%), and a much larger portion of workers demanded in helpers occupations (18.9%). Surprisingly this also implies that there was a larger portion of the moderately educated workers, those with HS-graduate or some-years in college education, demanded in helpers occupations (19.3% and 15.9% respectively). These proportions are much larger than that in the other main sectors. This only suggests that construction sector was also one of the first places for the unskilled labors to find jobs, and in the same time also one of sectors of last resort for those with more education.

Table 9. Percentage Distribution of Employment Demand in the Construction Sector by Occupation and Educational Attainment, Taylor County 1997.

Occupations	Percent of Employment whose educational attainment is					
	Less than HS	Some HS	HS-grad	Some college	≥ 4 years of college	Total
Managerial	1.2	2.3	4.4	11.1	27.2	7.0
Professionals	0.2	0.3	0.8	2.9	20.0	2.9
Sales Occupations	0.3	0.7	0.9	1.5	1.4	1.0
Clerical Workers	0.9	1.7	5.0	9.9	6.6	4.9
Service Workers	1.0	1.4	0.9	1.1	0.6	1.0
Farmers & Workers	1.0	0.8	0.4	0.4	0.4	0.5
Prod. Precision & Repairers	54.3	51.4	51.5	46.7	32.9	49.1
Operators	18.0	16.0	16.7	11.2	5.2	14.7
Helpers/Laborers	21.6	25.4	19.3	15.9	6.0	18.9
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0
% of All Education	7.3	19.7	45.4	15.8	9.8	100.0

Source: Imputed from Regional Economic Information System - Bureau of Economic Analysis, and 1990 Census of Population and Housing PUMS (5% sample) - Bureau of Census

How Demand for Educational Attainment is Distributed Across Industries and Occupations

Combining the observations on the characteristics of employment in each sector above with the aggregate figures given in Table 10 and Table 11 below, one can derive the

summary on how the demand for educational attainment is distributed across industries and occupations.

4-Years or More of College – Workers with educational attainment of 4-years or more of college, are demanded in the services sector (46.6%), retail trade sector (17.5%), and manufacturing sector (17.4%). Most of them are demanded for positions of professionals (47.5%), managerial occupations (16.4%), and sales occupations (11.1%). The occupational proportion, however, is different depending on the sector. Most of those professional occupations were in the services sector, which took up almost 75% of all the "4-years or more of college" employees working in the sector. Managerial occupations for this type of work were evenly available from the 4 dominant sectors, whereas the sales occupations were mostly available from the Retail-Trade Sector (46.1% of all the same type of employees working in the retail-trade sector).

Table 10. Percentage Distribution of Employment Demand by sectors and Educational Attainment, Taylor County 1997.

Industries	Percent of Employment of workers with educational attainment of					
	Less than HS	some HS	HS-grad	Some college	≥ 4 years of college	Total
Agriculture	1.4	0.9	0.5	0.4	0.3	0.6
Mining	2.3	1.9	1.8	1.3	0.9	1.6
Construction	14.7	12.2	11.2	8.3	5.6	10.1
Manufacturing	29.8	25.7	26.6	20.9	17.4	24.0
Transportation	6.7	6.0	6.4	6.1	4.8	6.0
Wholesale Trade	3.4	3.8	4.1	4.3	2.9	3.8
Retail Trade	20.8	25.6	24.1	26.0	17.5	23.3
Finance	1.6	2.3	3.7	5.2	4.0	3.7
Services	19.4	21.5	21.6	27.5	46.6	27.0
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0
% of All Education	6.3	16.2	40.7	19.1	17.6	100.0

Source: Imputed from Regional Economic Information System - Bureau of Economic Analysis, and 1990 Census of Population and Housing PUMS (5% sample) - Bureau of Census

Table 11. Percentage Distribution of Employment Demand by Occupation and Educational Attainment, Taylor County 1997.

Occupations	Percent of Employment of workers with educational attainment of					
	Less than HS	some HS	HS-grad	Some college	≥ 4 years of college	Total
Managerial	1.9	3.0	5.3	9.9	16.4	7.6
Professionals	0.9	1.7	4.0	10.4	47.5	12.3
Sales Occupations	5.9	12.4	13.9	17.5	11.1	13.3
Clerical Workers	3.3	5.4	14.4	21.1	9.5	12.7
Service Workers	21.5	23.9	15.3	13.3	5.0	14.9
Farmers & Workers	3.4	2.2	1.1	0.8	0.5	1.2
Prod. Precision & Repairers	23.6	18.5	17.1	11.5	5.4	14.6
Operators	28.0	21.2	20.5	10.3	3.2	16.1
Helpers/Laborers	11.8	11.9	8.4	5.2	1.3	7.3
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0
% of All Education	6.3	16.2	40.7	19.1	17.6	100.0

Source: Imputed from Regional Economic Information System - Bureau of Economic Analysis, and 1990 Census of Population and Housing PUMS (5% sample) - Bureau of Census

Some-College – Workers with educational attainment of some years of college, mostly were demanded in the four dominant sectors, 27.5% in the services, 26.0% in the retail-trade, 20.9% in the manufacturing, and 8.3% in the construction sector. Unlike the most educated workers, this type of worker is demanded for jobs that are quite evenly distributed across occupations (except of course for the farmers & workers occupation). A further examination shows that in fact most of the demand is more concentrated in the middle-level type of occupations, and only 20.3% held managerial and professional occupations. Surprisingly, 5.2% of them are demanded as helpers. All this suggests that this type of worker represents the upper part of the moderately educated workers, but the situation in the job market forces them to take some less interesting jobs. It was found that most of the helper occupation demand is in manufacturing and construction sector, implying further that these sectors may be sectors of the last resort for this type of workers.

High-School Graduate – High-school-graduate is the mode level of employees' education, so workers in this group should strongly represent the real moderately educated workers. As one would expect, the occupations for this type of worker were more concentrated in the middle level types of occupations (except for farmers & workers occupations), and only 9.3% of them held managerial and professional occupations. Also a larger proportion of them (8.4%) took helper occupations. As predicted, most of them got the jobs in the four dominant industries, 26.6% in the manufacturing, 24.1% in retail-trade, 21.6% in services, and 11.2% in construction. So far there was nothing surprising for this type of worker.

Some Years in High School – This type of worker is very similar with HS-graduate education worker. There was less demand for workers in managerial and professional occupations, and more in helper occupations. In general, however, the difference from that of the HS-graduate workers is not substantial, suggesting that year-differentials in the high school education is not a major determinant of employment prospects. The most

notable difference is the fact that there were much more of them were demanded in service workers occupations (23.9% compared to only 15.3% for the HS-graduate labors). It was found that most of service-worker occupations were available from services and retail-trade industries.

Less than High School – Usually some specific information about the job-market situation can be told by the situation in the top and the lowest ranked of workers. There were a small number of workers demanded (6.3%) in the Taylor County with less than high school education. The fact that there were a significant number of workers with such education demanded in the job market suggests that there was not enough labor supply for firms to hire people for their jobs. Notice also that there were about 2.8% of workers of this type demanded in managerial and professional occupations. The most probable explanation for this type of worker is in charge of their own small establishments, or that they had built larger operations from small start-ups.

Many of the least-educated workers mainly were demanded in manufacturing (29.8%), retail-trade (20.8%), services (19.4%), and construction (14.7%). Of all these workers 11.8% of them were demanded in helper occupations, and it was found above many of such occupations were available from manufacturing and construction sectors. This is a good indication that if there were many other more-qualified workers working for the same occupations in the same industries, then the two industries are most likely to be sectors of the last resort.

A significant number of these workers also held service workers occupations (21.5%). Above it was found that many of the service-worker occupations were available from the services sector and retail-trade sector. Because the same thing was also found for workers with "some-HS" and "HS-graduate", and even "some-college" education, then this suggests that this type of jobs in the two industries required a broad range of skills.

Comparison of Results from Different Data Sources[7]

As mentioned above four different methods are feasible. Figures 1 to 5 describe how the pattern of occupational distribution of employment demand for each group of workers (categorized by their educational attainment) differs due to the use of different data sources. At first look they show that method Census 90_2 and Census 90_3 surprisingly yield very similar patterns. This suggests that creating the requirements matrix in one step versus two steps does not make substantial differences. In other words it is legitimate to say that the assumption of fixed proportions of educational attainment for each occupation across industries is not a bad assumption after all, at least in the case of Taylor County.

[7] Unfortunately the study so far failed to separate "operators" from "helpers" in the OES 97 survey data due to the lack of control over the data. Obviously the comparison will be much more interesting if these two occupations were identified independently. The study will continue trying to overcome this problem. This is only a preliminary analysis. The study expects to do a further analysis of comparison.

The figures also show that in general the results obtained from CPS_97 seem to be off-chart all the time, whereas those of OES_97 differ only slightly from those of Census-90. Part of this is due to the fact that OES_97 method uses in part the same information as it as used in the Census 90 method (that is data (1)).

Compared to Census 90, CPS_97 tends to produce lower estimates of demand for workers in the low-level occupation (operators & helpers), and higher estimates for workers working as managers and clericals. There is no clear tendency for the number of workers in the other occupations either to yield lower or higher estimates. On the other hand OES_97 tends to produce higher estimates on number of professionals, but lower estimates on number of operators & helpers. It is interesting to see whether the differences in the occupational distribution are really due to changes in the economic activities or due to errors related to sample scaling.

Figure 1 Pattern of Occupational Distribution by Different Data Sources: Workers with 0-8 Years of Education

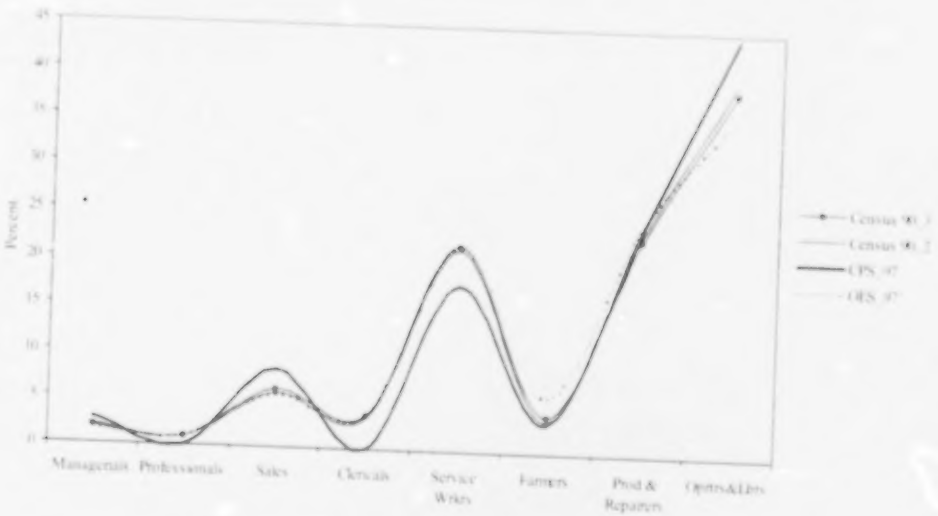

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Figure 2 Pattern of Occupational Distribution by Different Data Sources: Workers with Some Years in High School

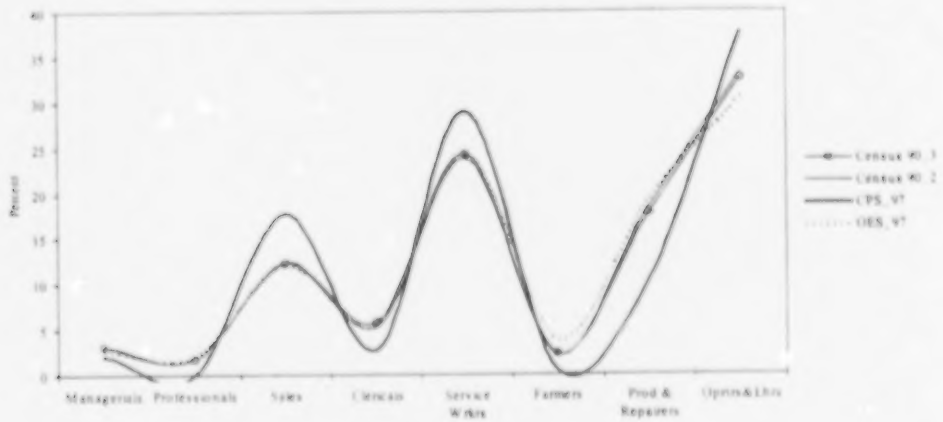

Figure 3 Pattern of Occupational Distribution by Different Data Sources: Workers with High School Graduate Education

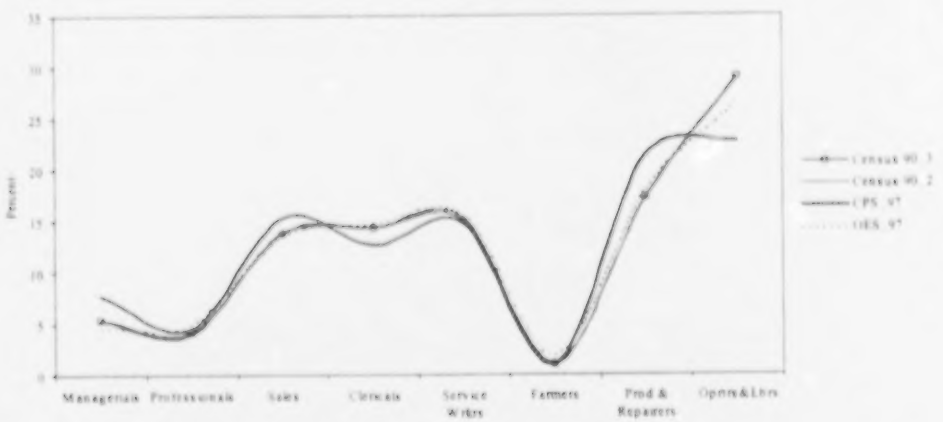

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Figure 4 Pattern of Occupational Distribution by Different Data Sources: Workers with Some Years of College Education

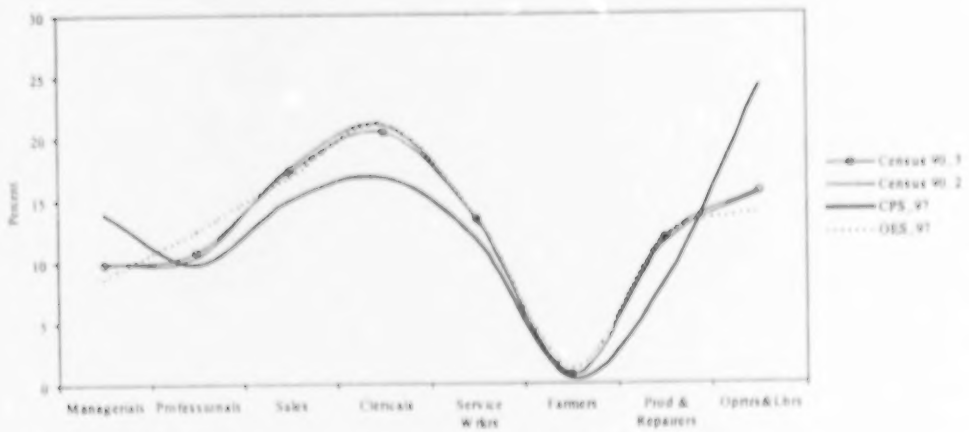
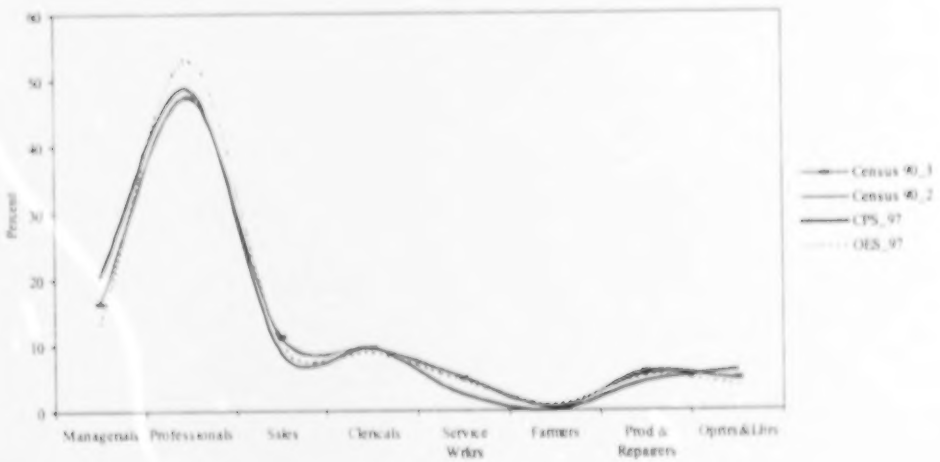


Figure 5 Pattern of Occupational Distribution by Different Data Sources: Workers with Four Years or More of College Education



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Conclusion

Goetz and Debertin method prove to be powerful to help local government to get meaningful information about its local employment. By providing compact information on employees' education and how it relates to their occupation and sectors, this method allows people to see how skills requirement (indicated by educational attainment) for the same occupation differs when the demand comes from different sectors. The method also allows people to see how education matters differently in obtaining higher rank of occupations when one works for different sectors. Provide that the estimate from this method is reliable, then local government can now forecast the demand for educational attainment based on a single forecast of local economic growth by sectors (which is a common forecast). Last but not least, this method also gives a better way in assessing the kinds of training needed for the workforce. In practice, however, to really decide the kinds of training to be provided for the public, there are still various practical issues that the government has to deal with.

This method, however, deals only with aggregate features. There are only nine major categories of sectors and nine major categories of occupations, whereas in reality, even jobs that belong to the same occupation title can be very different in nature. In other words this is to say that conclusions derived from this method should pertain only to the big picture. Technically speaking, however, forcing such a method to come up with more detailed information would yield meaningless information. As a result, to get more a detailed picture one can relate this method with another data source, such as American Business Disk. This disk provides information on individual businesses in a county with their type of goods/services they produce. From this disk one can identify in detail what exactly the kind of businesses in the services sector, are they food service, or business consultant, or security service etc.

In the future, as communication technology advances and survey costs fall significantly, the government might eventually be able to conduct surveys using a much bigger sample size. Witch such a survey, the Census Bureau could produce information that is already broken down to county level. If that is the case, once more detailed secondary data are made available one might think that the Goetz-Debertin method would lose its value. That is, however, only partly true. People might not need to use the method to estimate the demand for educational attainment, but they can still use the same method to estimate any other local information. In other words, as long as there is still gap between national or state level data and local data, there is still room for people to make use of this method.

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Appendix. How the Method Estimates

State-Level Data:

Data 1:

	Industry-P	Industry-Q
Occupation-a	Pa	Qa
Occupation-b	Pb	Qb

Data 2:

	Education-1	Education-2
Occupation-a	1a	2a
Occupation-b	1b	2b

The Requirement Matrix.

	Industry-P		Industry-Q	
	Educ-1	Educ-2	Educ-1	Educ-2
Occup-a	[Pa*1a]	[Pa*2a]	[Qa*1a]	[Qa*2a]
Occup-b	[Pb*1b]	[Pb*2b]	[Qb*1b]	[Qb*2b]

Note: [..] => The sum of employment in one industry is normalized to 1 ==> [Pa*1a]+[Pa*2a]+[Pb*1b]+[Pb*2b] = 1

Assumption:

1. Fixed proportion of education for each occupation, regardless of the types of the industry.

County-Level Data:

Data 3:

Industry-P	Cp
Industry-Q	Cq

Data 3 'Kronecker' the requirement matrix

The County-Level Demand for Educational Attainment

	Industry-P		Industry-Q	
	Educ-1	Educ-2	Educ-1	Educ-2
Occup-a	[Pa*1a]*Cp	[Pa*2a]*Cp	[Qa*1a]*Cq	[Qa*2a]*Cq
Occup-b	[Pb*1b]*Cp	[Pb*2b]*Cp	[Qb*1b]*Cq	[Qb*2b]*Cq

Assumptions:

1. Fixed proportion of education for each occupation, regardless of the types of the industry.
2. Fixed proportion of occupation per industry across counties within West Virginia.